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THE UNIVERSITY DEPARTMENT OF MEDICINE

THAT all is not well with medical education is obvious from the number of investigations, addresses, polemics, plans and schemes which at present center about this subject. In the writer's opinion the root of the difficulty lies in the extremely close association which has always existed and exists to-day between medical education and practise, and in the idea which generally prevails that the problems relating to medical education and those having to do with the practise of medicine are inseparable. While many persons admit for purposes of discussion that a line of separation exists between the science of medicine and the art of the practise of medicine, yet when these individuals begin to think in practical terms, they fail to take this fact into consideration. Indeed, in their inmost souls, most medical men refuse to admit that medicine is a science, or they think of the scientific side of the subject as something apart from medicine itself, as though scientific medicine were simply the group of underlying sciences upon which medicine depends for sustenance. Even Sir Clifford Allbutt, in his remarkable essay on the "New Birth of Medicine," speaks of the new birth as an "enlargement from an art of observation and empiricism to an *applied* science . . ., from a craft of tradition and sagacity to an *applied* science." Why is it that we can conceive of medicine only as an application of science to an "art" or "craft," and not as a new, real and independent science replacing an obsolete mass of tradition and empiricism?

It is true that the science of medicine is in the process of making—but so is every other science. There is no such thing as a rounded, completed or finished science. At any given time any science is but the result of all previous attempts to arrange in order and to explain

the facts and phenomena relating to some field of knowledge which is more or less definitely outlined, and which is large enough and important enough to deserve such treatment. As new facts are constantly being discovered in all realms of knowledge, all sciences are in a constant state of development.

The abnormalities and functional disturbances of man surely constitute a large and important field of human interest. Marked advances in knowledge concerning the phenomena and nature of disease have already been made, especially in recent years, and this knowledge is constantly being arranged, and the phenomena are being studied in their relation to each other and to other phenomena. Medicine, then, is developing just as other sciences have done and are doing; its subject-matter is receiving the same kind of treatment that is succeeding in other domains of human knowledge. Therefore, on account of the importance of the subject, and because of the advances which have already occurred in our knowledge concerning disease and the progress which has been made in the scientific treatment of this knowledge, medicine deserves to rank as an independent science.

If physiology may be an independent science, if anatomy may be an independent science, why not medicine? Why should medicine be only an *applied* science, any more than anatomy or physiology? Anatomical and physiological knowledge may be applied to practical affairs as well as medical knowledge. Why should medicine be inseparably associated with the doctor's consulting room any more than anatomy with the surgeon's operating room or the artist's studio?

Since definition is more important than argument, let us consider what we mean by medicine, or better, the science of medicine. First, let us consider what it is not. It is not anatomy, it is not physiology, for these sciences deal with the normal or healthy; it is not pharmacology, strictly speaking, for as this science has so far developed, it has dealt with the nature of drugs and their action on normal animals. These sciences, however, together with such fundamental sciences as chemistry and physics, are frequently spoken of as the medical sciences, the institutes of medicine, or indeed collectively as the science of medicine.

To define exactly what medicine is is not easy. Medicine deals with disease, the antithesis of health; it deals with the abnormal, the departure from the average. When we come to consider whether medicine includes all aspects of disease, or only certain ones, we meet with difficulties. The accepted use of the term does not aid us, for there is no universally accepted use, even among the most strict and thoughtful men. The dictionaries define medicine as the science and art dealing with the *prevention, cure* or *alleviation* of disease. Pathology, on the other hand, is defined as the science treating of the *nature, causes, progress, manifestations* and *results* of disease. According to the definitions, therefore, pathology has to do with the nature of disease, medicine with the application of that knowledge. That these definitions are purely academic, however, and not real, is made evident by referring to the text-books dealing with these subjects, for we must consider that the text-books of the day present not only the accumulated knowledge concerning the subjects treated, but also the contemporary conception of the boundaries of these subjects.

If we refer to any text-book on medicine, whether it be labelled practical medicine, the practise of medicine, or merely medicine, and look up any disease, it will be found that nine tenths of the subject-matter deals with the "nature, causes, progress, manifestations and results" of the disease, under the headings etiology, symptomatology, complications, prognosis and so forth, and only one tenth deals with prevention and cure. On the other hand, most text-books of pathology do not treat of the "nature, causes, progress and manifestations" of disease at all; they consider only the morphologic changes resulting from disease. It is evident, therefore, that the definitions of pathology and medicine quoted above are obsolete, even though practitioners of medicine may not take cognizance of the fact. In my opinion, the old implied distinction between pathology and medicine has had a blighting

effect upon the development of medicine as a science. Twenty-five years ago, however, it became dimly recognized that this distinction between medicine and pathology is not a real one, at least that pathological anatomy is an essential part of the science of medicine. The improvement in the teaching of medicine which occurred at that time and the resulting increase in medical knowledge may be directly traced to this new conception.

It is of importance that medicine should now be generally recognized as an independent science, just as physiology and anatomy are independent sciences. *Medicine may then be defined as the science dealing with the phenomena of disease.*

Let us grant now that there is or may be a science dealing with disease. How can this science best be fostered and how can this new science be most effectively utilized? As our medical schools are now organized, they are composed, on the one hand, of a group of departments devoted to the teaching and development of the so-called contributing sciences, anatomy, physiology and pharmacology; and on the other hand, of a large group of distinct departments, the chief function of which is to train men for the practise of medicine. As I have previously stated, however, anatomy, physiology and pharmacology have only the same relation to medicine that chemistry and physics have to anatomy and physiology. That the departments of anatomy, physiology and pharmacology are not independent university departments, but are included in the medical school, is in my opinion only accidental and is not an essential condition for the development either of these sciences or of medicine. The inclusion of these departments in the medical school has occurred chiefly because almost all the students working in them expect later to study medicine. Not so many years ago, however, practically all students of chemistry likewise expected to study medicine, and in many colleges the department of chemistry was also included in the medical school. To-day only a relatively small number of the students of chemistry look forward to the study of medicine, and in consequence, the department of chemistry constitutes a part of the medical school in only a very few universities.

The present organization of the medical school, therefore, has been largely influenced by expediency and by the effort to obtain economy in administration. With a satisfactory university administration, the department of medicine (and under this term I include all the departments of the medical school that are engaged in the study of disease) might perfectly well constitute the whole medical school, probably with considerable advantage to the departments of anatomy and physiology. With the present laws governing medical practise, however, it is necessary that the grouping of various departments into medical schools be continued. There is no serious disadvantage in this so long as there is a full realization of the reasons for this grouping, and so long as the relation of the various departments to each other and to the university, and especially the relation of the department of medicine to the university, is kept clearly in mind.

During the past fifty years a marked improvement has taken place in the departments which are concerned with the so-called contributing sciences. In many schools these departments now rank among the strongest university departments, both in the quality of the instruction and in the contributions which they make to the advancement of knowledge. One of the most important of the factors which have contributed to this improvement has been the release of these departments from the restrictions imposed upon them by those engaged in the practise of medicine. No longer are the teachers themselves practitioners of medicine, no longer is the efficiency of the department judged entirely by the contributions made to the immediate demands of practise. That is, they have become true university departments.

The department concerned with medicine, however, has not developed in the same way. There the demands of practise and the needs of practitioners are still the controlling factors in organization and development. As one result of this there has been developed within the department of medicine numerous branches hav-

ing little coherence and no general guiding principle of organization or function. In many schools some of these branches have become much more important than the parent stem, both as regards resources and as regards the character of the work which is undertaken. There are departments of surgery, of orthopedics, of psychiatry, of genito-urinary diseases, of gastro-intestinal diseases, of pediatrics, of ophthalmology, of dermatology, of laryngology, of endocrinology, of elecerotherapeutics, and so forth, and so on. Some of these departments, owing to the skill and prominence of the professors in practise, have acquired buildings and equipment of greater extent than the educational importance of the subjects warrants, and of far greater extent than the scientific development of these subjects justifies.

It is true that one additional circumstance has contributed to this extensive partitioning of the department of medicine. Most universities and medical schools have been compelled to employ general hospitals for teaching purposes, hospitals which were primarily planned and organized to care for the sick poor. Now, within limits, the larger the general hospital, the more efficiently and economically it can be conducted, and in the medical and surgical treatment of large numbers of persons, a high degree of specialization has been found to be most effective. It does not follow, however, that the same principles which should apply to the organization of a general hospital should also apply to the organization of a clinic designed primarily for investigation and teaching, merely because both have one function in common, namely, the care and treatment of the sick. The university department of medicine has an added function, the investigation of disease and the teaching of students, and if a general hospital is to serve this added function, its organization must be modified accordingly.

In the efforts which have been made to improve the teaching of medicine, not infrequently that division of medicine having to do with the study of so-called internal diseases has received the least and last consideration. These diseases, however, because of the suffering and loss of life which result from them. are of far more practical importance than any other group of diseases. Of much more significance than this, at least from the educational standpoint, is the fact that the diseases of internal medicine are the ones which are most susceptible to scientific study, and thus far they are the principal diseases to which modern scientific methods of investigation have been applied. They are therefore the diseases with which the student of medicine should be chiefly concerned during his earlier years. It is in the study of these diseases that the student should develop his perspective and should obtain a knowledge of the methods which should be employed in the study of all other diseases. For this reason, in writing the following discussion of the department of medicine as a whole, I have had the division of internal medicine chiefly in mind, for this division should be a pattern for all the others.

Bearing in mind our definition of medicine and the conception of the boundaries of the department of medicine which we have adopted, let us consider what we mean by a university department of medicine. It is a department designed for the purpose of studying and investigating diseases, of accumulating and distributing the existing knowledge concerning disease and of contributing to the extension of this knowledge.

What is needed to create a university department? Exactly the same materials that are required in every other scientific department of the university—men, laboratories and books; and the most important of these is men. By men I mean students, of various grades. Some, the more advanced, we call teachers; the others, less developed, we call students; but they must *all* be constantly acquiring knowledge or the department is a failure. Moreover, the essential requirements for admission must be the same for teachers and students, though differing in degree. They must all have the desire for acquiring knowledge, they must have the desire to add to knowledge, and they must have the training and ability to enable them to carry out their desires. While all science is complex and all sciences are mu-

tually dependent, medicine seems the most complex of all. To know the abnormal we must have knowledge of the normal. That is, whatever is known of structure of the human body and the little that is known of function must be available. In other words, knowledge concerning anatomy and physiology must be in the possession of every student, and knowledge of these sciences requires knowledge of chemistry and physics. These are well-recognized facts that need not be dwelled upon further.

Are men available for such a department, as teachers and students, men who are interested in the study of disease and who desire to increase the knowledge concerning disease without any other material reward than the rewards of the student and scholar? Or has scholarship gone out of fashion? Or is this such an uninteresting subject that no men can be found to undertake its study? As long as men will study the stars with scientific methods, as long as men will study the stones with scientific methods, men will be found to study disease. The men are ready and waiting, the opportunity only is needed.

The second essential is laboratories. The astronomer must have his telescope through which to observe the stars; he must also have his chemical and his physical laboratories. The student of medicine must also have *his* observatory, the hospital, and in this he should also have laboratories—*his* laboratories—and not be a guest or intruder in laboratories belonging to other scientific workers—chemists, physiologists or others. It is just as impossible that the science of medicine can be studied at the bedside alone, where only superficial observation is possible, or that it can be studied only in the laboratory, where disease as it occurs in man is never present, as that astronomy can reach its highest development by observation through the telescope alone, or by spectroscopic and chemical studies alone. It is not uncommon that the contributing sciences in the medical school are spoken of as the *laboratory* branches and the medical divisions are spoken of as the *clinical* branches. This in my opinion reflects the mistaken opinion which prevails concerning the nature and proper methods of the study of medicine. For the development and teaching of medicine, laboratories are as essential as they are for the study of physiology. But if they are to be used, they must be in close proximity to the wards, and they must be so arranged and organized that the work in the laboratories and in the wards can go on simultaneously and harmoniously in both. This conception of the hospital, however, is rare even among those who take the most advanced views concerning medical education. I know of one university hospital which is being planned before the professors or staff that are to work in it have been appointed. No architect or hospital superintendent can possibly accomplish this task. For instance, the superintendent of a general hospital must, of necessity, take an entirely different view of a hospital from the one which has been sketched. It would be just as sensible to have a foreman of a machine shop design a laboratory for the department of physics as to have a hospital superintendent design a university hospital. In each case the superintendent or foreman might be of great assistance and give useful suggestions, but he would be as incapable of conceiving the purpose, and therefore of working out the idea, in the one case as in the other.

It can not be denied that it will be expensive to install in each clinic of the hospital well-equipped laboratories in which the varieties of technique already developed in bacteriology, physiology and chemistry, can be used, and in which entirely new methods may be devised. This is essential, however, if the science of medicine is to develop. In a given clinic probably all the laboratories would not at any one time be of equal importance. In each clinic the development would probably be mainly along special lines. If the division of internal medicine, for instance, was a large one, there might be several clinics or units, in one of which the chief attention would be given to one variety of disease, in another, to another variety. In the study of human disease, however, much is gained in economy and effectiveness if studies take not only one, but several directions at the same time. The sub-

jects studied are so complex that it is wasteful to confine an investigation to a single narrow path. Thus in studying a group of patients suffering from an infectious disease, it is frequently important that they be studied not only from the standpoint of etiology, in which the chief work will be done in the bacteriological laboratory of the clinic, but it may be of great importance that, at the same time, alterations in metabolism and disturbances in function of the circulatory and respiratory systems be investigated, in which case the laboratory and technique of physiology or possibly of physics will be required, and on the same patients chemical studies of the blood or excretions may be valuable, all of which must be carried out in the special laboratories of the clinic. By carrying out all these procedures on the same patients, not only is expense saved, but each observation gains much in importance by being supplemented by the others.

In the university department of medicine there should not only be facilities for studying disease as it occurs in man, but there should also be facilities for carrying out experimental studies on animals. In many cases only by animal experimentation can the suggestions obtained from detailed observations on patients be confirmed or disproved.

With regard to the library, little need be said here except that it must be alive, not dead.

The above is my conception in brief of the essentials of a department of medicine in a university. Grant a central concept such as this on which to build, and it will not be difficult to elaborate the details, at least it will not be impossible. For instance, let us consider the number and kinds of the divisions into which any given department of medicine shall be divided, or in other words, the kinds of diseases for the study of which special clinics shall be provided. There can be little question that the diseases spoken of as surgical (because operative technique is employed in treating them) are of such great importance and the technique of their therapy has become so specialized, that one or more clinics of the department should be devoted to the study of these diseases. This does not mean, however, that the methods employed in studying these diseases differ from those used in studying any other group of diseases. Exophthalmic goiter is the same disease whether we treat it by removal of the thyroid or by rest and drugs. Whether we call the professor who studies especially those diseases in which the chief therapeutic procedures are operative, a professor of surgery or a professor of medicine, is unimportant so far as the principle is concerned. His methods should be those of the professor of medicine as I have sketched him, and the surgical clinic should be exactly like the medical clinic with the addition of facilities for employing complicated operative procedures. The same principle should also govern the organization of the division of pediatrics or any other one of the divisions into which it is decided to separate the department of medicine.

The exact number of divisions in any department of medicine will have to depend upon the men and resources available and upon the contemporary state of knowledge concerning the various groups of diseases, and upon the immediate importance of increasing this knowledge. There seems to be no good reason, however, for dividing the department of medicine into a great number of divisions and subdivisions. Indeed, from the educational standpoint very great disadvantages are inherent in this method, owing to the scattering of interest which results. The efficiency of a department of medicine does not depend upon the number of its clinics or instructors, or upon the variety of subjects treated. The attempt to present to the student every known fact and theory concerning disease and to exhibit to him examples of every known form of disease only causes him to become confused and bewildered. What is much needed at present in medical education is the elimination of the unessential and the untrue. No student can be expected to learn all that has been thought about disease and all the theories that have been proposed. He should have, however, opportunities to learn what is actually known about important diseases and to receive the

kind of training that will enable him to discriminate between the true and the false.

A further detail of the organization of the department of medicine concerns its relation to the department of pathological anatomy. From what has been previously stated, it is obvious that the department of pathological anatomy should constitute an integral part of the department of medicine. The laboratory of pathological anatomy should be closely connected geographically, as well as in organization, with each one of the clinics. It should not be a block or a mile away from the clinics, or even in an isolated building on the hospital grounds. *It should be physically a part of the department of medicine.* There would be a great advantage in having at all times at least one assistant from each clinic acting as a member of the pathological staff. Each of these assistants should be engaged, under the direction of the professor of pathological anatomy, in studying and teaching the anatomical changes resulting from the special group of diseases which is being studied in the clinic which he represents. On the other hand, the professor of pathological anatomy should be a member of the administrative staff of the department of medicine. The effect of such an association as I have described would not only be of great educational value, but I believe that it would bring about a "new birth" of pathological anatomy.

The objection will probably be raised by some that, although the introduction of the proposed principles and plans into the department of medicine might result in a greater and more rapid accumulation of knowledge concerning disease, it would have no immediate effect upon society at large or upon the practise of medicine. If this were so, the value of the plan might be questioned, though I would not go so far as to deny its value even under these circumstances. I assume, however, that one of the most important functions of the department of medicine must be to train men in order that they may become capable practitioners of medicine. Now the practise of medicine, or the practical application of the science of medicine, may be considered to be directed in several lines:

1. Prevention of disease or decay.
2. Diagnosis, care of the sick and alleviation of pain.
3. Cure of disease.

At the present time the first function of the practising physician is exercised in a very minor degree. The medical schools take little cognizance of it. Therefore we may omit discussion of it here, though in my opinion it is the most important of the three, and the department I have in mind would exert great effort upon the development and extension of this function.

The second important function of the practising physician is to make diagnoses, that is, to bring the particular symptoms from which a patient suffers and the most striking features of his malady into relation with a group of symptoms and signs which have already been described and given the name of a disease. This is of great importance from the standpoint both of prognosis and treatment. Originally the classification of disease was empirical; later it was founded, in part on an anatomical, in part on an etiological basis, and in part merely on the presence of some striking feature. There is much that is empirical, superficial and traditional in this subject; nevertheless, in the present state of the science, it is important. The physician, therefore, must be trained in the methods of diagnosis. He must be trained in the method of Zadig. There are many tricks, short cuts and simplified methods in diagnosis with which the practising physician should be familiar, though they have not an essential place in the fundamental science of medicine.

At present, however, the chief efforts of the department of internal medicine in our medical schools are directed towards the cultivation of diagnostic skill in the student. Much time is frequently devoted to the recognition of some rare disease, even though only a half dozen cases have ever been recognized and although nothing essential about the disease itself is known. Indeed the more unusual the special group of signs and symptoms, the more im-

portant does it seem to become. An analogy may be drawn to the state of affairs lately existing in botany when the chief attention was given to the classification and naming of plants. We now know that this is only a part, and a relatively unimportant part, of the science of botany. A man may still be a great botanist even though on walking through a field he may not be able to name correctly every plant or tree which he meets. While diagnosis in medicine is important, its position in the educational scheme is misplaced. Instead of placing it at the beginning of the study of medicine, it should come later, after a knowledge of the more fundamental principles of medical science has been acquired. If a student knows much about a few of the common, more important forms of disease, the recognition of the rare forms will be relatively easy.

Another function of the practising physician is the care of the sick and the relief of pain, mental and physical. Part of this labor is borne by the nurse, but the physician must bear the larger share, and if he is able to analyze disturbances in function, he is oftentimes able to bring relief even though he can not cure.

One of the chief efforts of the physician is to establish a feeling of confidence in the patient and in the family, and to relieve anxiety. The success of this effort depends largely on personality, but consciousness of real knowledge is a most important factor contributing to such an inspiring personal relationship.

In our present system the student learns less about therapeutics than about any other feature of disease. For a system of education that claims to be essentially practical, it obtains most impractical results. However much we may rail at the ineffectiveness of treatment —and the best practitioners are accustomed to do this—there are at least a few therapeutic measures that are of great effectiveness and a few diseases over which the physician has absolute control. Yet how little does the student actually learn during his student days of the really practical methods of employing these measures! How ill prepared he is to meet actual conditions, unless the procedures to be employed are of the greatest simplicity!

By present methods, therefore, students are not well trained, even in the elements of practise, except as concerns diagnosis. They should be better trained for practise.

In order to judge of the probable effect of the proposed plan, not only on the development of the science of medicine, but on the practise of medicine as well, let us sketch briefly the proposed organization of the division of internal medicine and the nature of the work which it is intended should be carried on.

The number of clinics which compose the division of internal medicine will depend upon the funds and men available and upon the size of the university or school. Each clinic, however, should have, let us say, a hundred or a hundred and fifty beds, its own independent laboratories equipped for the prosecution of chemical, physical, physiological and bacteriological studies, as well as laboratories for pathological anatomy and facilities for animal experimentation. The number of students admitted should be limited; these students should have had a general college, scientific training, preferably with specialization in chemistry, physics or biology. Before admission to the department of medicine, they should have studied anatomy, physiology and bacteriology. This work may have been done in any university. The custom of studying one subject in one university, and another subject in another university, should be encouraged. This would result in bringing into the department methods and points of view derived from many sources.

The teachers should be carefully chosen young men who have had a good training in clinical methods and who are also well grounded in at least one of the contributing sciences, some in chemistry, some in physiology and so forth. Before appointment, they should have given evidence of ability not only to teach but also to aid in extending the boundaries of medical knowledge. In this department brief courses should be given in the methods for observing and recording the more

superficial features of disease, history-taking, physical diagnosis, X-ray examination, etc. There should also be courses in pathological anatomy, including study of the blood and other tissues that can be obtained during life, courses dealing with the application of physiological and chemical methods to the study of disease, and courses devoted to the study of the pathogenic bacteria and other parasites. As soon as possible, the students should begin the actual study of disease as it occurs in the patient, and the results as seen at autopsy. The students should spend a large part of their time in the wards and laboratories, making their study at first hand and relating all that they do to actual cases of disease. Reading must be encouraged and the student should be urged to consult original sources. It might be advisable to have the student devote a given period of his course to the study of infectious diseases, during which period much of his time would be spent in the bacteriological and pathological laboratories of the clinic. In another period the time would be spent mainly in the study of so-called diseases of metabolism, during which period he would have his working place and spend much time in the chemical laboratory of the clinic.

During his course the student should make an intensive study of at least one disease, making an attempt to learn all that is known about that disease, repeating with his own hands the important steps which have led to present knowledge, and if possible, he should add something, however slight, to existing knowledge concerning this disease. By means of seminars and conferences, both at the bedside and in the laboratory, each student would at all times be kept in touch with the work of all the other men in the clinic—students and teachers. The student would himself become an instructor of his fellow workers. The teachers would be engaged in directing and assisting the students in this work and in carrying out their own investigations.

At the end of two years the student would have acquired a great deal of knowledge about a considerable number of diseases, their prevention, nature, causes and treatment, and would be well trained in the methods of studying disease. He would also be familiar with the methods and principles of diagnosis.

It may be true that the department of medicine I have sketched will not provide the student with the wide experience with disease in its various manifestations which would make him an able practitioner. But even with present educational methods, no one assumes that immediately after a student obtains his degree he is a capable, or even a satisfactory practitioner of medicine. It will be asked, where, under the system proposed, will the student get this wider experience and practise in technique. He will get it exactly where he gets it now, in the hospital year or years, or where he used to get it, in actual practise. No better system for producing good workmen, be they physicians or bricklayers, has been devised than the apprentice system. It is of great importance, therefore, that a good example be set in the hospitals in which students obtain experience and skill in the practical application of medical principles; this is almost as important as it is that the work in the university should be of the right kind. While the hospital can only occasionally and with difficulty make good practitioners of men who have had little or poor training in the science of medicine, it can very easily ruin men, however well they may have been fundamentally trained. There will always be the opportunity and need for good practitioners who teach by example. The preceptor system is of great value in its proper place. The trouble with the present system of medical education is that it consists almost exclusively of the old preceptor system employed in a wholesale and frequently inefficient manner. Modern developments require for medical education a scientific basis, with a final polish added by a preceptor system correctly applied.

The question will now be asked: Should the professors of medicine in the university department of medicine be trained in clinical medicine, or may they be men who have been trained only in physiological methods or chemical methods, or who have had experience with disease only as it occurs in experimental ani-

mals? In my opinion, the professor of medicine must be prepared to study the symptoms and the more superficial manifestations of disease as seen in patients, as well as to carry on complicated laboratory investigations. It is chiefly through the observations of patients that clues are obtained as to the proper direction the more complicated studies should take. It is true that much knowledge concerning disease has been obtained by bedside study alone. In the present state of the science of medicine, however, this method of study is now relatively unproductive, and unless combined with more elaborate and complicated methods is likely to result chiefly in the elaboration of theories. While theories are of importance in the study of disease, just as they are in all scientific inquiry, they are of little value, until tested by experiment.

An additional reason why professors of medicine should have a wide knowledge of disease as it occurs in man is that they will themselves have to be responsible for the care and treatment of human beings sick of disease. It is essential not only that no harm come to the patients who are the objects of study but that everything possible be done to bring every one to a state of health, or as near that as possible.

To avoid the necessity of having as teachers of the science of medicine only such men as have enjoyed a wide experience with disease in all its forms and who possess a knowledge of the craft or art of practise, two makeshifts have already been attempted. One expedient has been to have men skilled in practical medicine take over the actual care of the patients, while the real studies are made by those who have special knowledge of one of the sciences, but who have no knowledge of practise, possibly no knowledge of disease. For instance, the physiologist is invited into the clinic to make observations or studies on certain cases. In some instances this method has no doubt led to advances in knowledge. It has distinct limitations, however. Oftentimes the facts accumulated in this way have very little immediate practical significance, whereas if the observations had been made by persons properly trained in medicine, possibly only a slight modification in the methods employed would have made the data obtained of great practical value. Combined investigation such as this has made little impression on the method of study of disease or on the men who are constantly engaged in the study or practise of medicine. Indeed it has a blighting effect on the scientific aspirations or scholarly ambitions of the men in the department of medicine. Specialists in the various branches of science can always be employed in the university department of medicine to give advice, to assist, and even to share in investigations, but the department will reach its greatest effectiveness only when the men engaged in teaching medicine and in investigating disease have not only a wide knowledge of disease as it occurs in man, but special training in one or more of the so-called contributing sciences as well.

The second expedient is to establish in connection with the medical school a department of experimental medicine, or research medicine. This is neither sound in theory nor effective in practise. It is better than nothing, but its establishment in a medical school means that the teaching of medicine will go on in the same old way, although a certain amount of reputation may accrue to the school from the fact that investigations are carried on within its walls. The employment of this makeshift has arisen from a disinclination to make any fundamental change in the old order, while recognizing that change is necessary. It arises from the recognition by those already engaged in teaching that they are not prepared to adopt new methods. These teachers do not object, however, to grafting a new department on the old one, so long as they personally retain their old prestige and perquisites. In certain schools, both in this country and in Europe, it has been proposed to divide the medical school clinics into several units, one or more of these units to retain their old character, more or less obviously, one or more to be organized into so-called full-time or university clinics, the latter term being the one which I prefer because it puts the emphasis upon the character of the work. If certain schools want to try out this method, one can not object. It is very doubt-

ful, however, whether the need for reform can be met in this manner and it seems that the reorganization of the medical teaching in such a half-hearted way is almost bound to result in failure.

It will be noted that up to the present I have not mentioned full-time or part-time employment as applied to teachers. With the conception of a department such as I have tried to present, this question settles itself. To make scientific progress requires all of the time of the most able-bodied and able-minded men that we now possess. We are not discussing a practical trade school, but a scientific university department dealing with one of the most interesting, the most important and the most complex branches of human knowledge. Could any teacher engaged in this great work want to neglect it to engage in a practical pursuit for money? If so, he has no place in this institution. If public humanitarian appeals should sometimes call him away from his hospital and laboratory, probably that would be good for him. In any case, it does not seem that we need to worry that this will interfere too much with his work, unless human nature changes.

The very important question may now be raised whether the proposed plan would not have exactly the opposite effect on the development of the science of medicine from that intended. If men in the departments of physiology and anatomy and the other contributing sciences should no longer engage in the solution of medical problems, would not the result be disastrous? It is not intended, however, that the organization of the department of medicine in the manner described would prevent men in any other department of the university from undertaking the solution of medical problems. Men in the department of physiology have been known to contribute to anatomical knowledge and the investigations in the department of anatomy are not infrequently directed toward the solution of physiological questions. It is to be hoped and expected that in the future as in the past all the departments of biological and physical and chemical science will bring contributions to medicine. The fact that the department of medicine is itself investigating the problems of disease need have no deterring influence on these other departments; indeed this fact would undoubtedly increase the interest of the other departments in medical science. On the other hand, the university medical clinic might itself become a contributor to these other sciences. For instance, it will not infrequently happen that in order to approach its own problems, the medical clinic may first have to undertake the solution of problems which are commonly studied in the chemical laboratory or the physiological laboratory, and so on. Indeed, under certain circumstances it may be necessary to devise new bacteriological or chemical methods or new physical apparatus. Neither the student of medicine nor the student of any other branch of science should be restricted in his methods; though the student of medicine may not lose sight of the fact, that however far off his goal, his ultimate concern is with the problems of disease.

I firmly believe that if a department of medicine such as has been described were established in a first-class university, a greater advance would be made in medical teaching and in medical science and practise than was made in this country twenty-five years ago.

The one essential premise is that there exists or can be created such a thing as a science of medicine. If this is true, this science can best be fostered by giving it a place in which it can grow unhampered by the restrictions of practise. Medicine must be regarded as a real science, not an "*applied science.*" The proper applications are important but in this place they should not dominate.

Let us labor to place the teaching of medicine in its true position. Let us emancipate the student, and give him time and opportunity for the cultivation of his mind, so that in his pupilage he shall not be a puppet in the hands of others, but rather a self-relying and reflecting being. Let us ever foster the general education in preference to the special training, not ignoring the latter, but seeing that it be not thrust upon a mind uncultivated or degraded. Let us strive to encourage every means of large and liberal education in the true sense of

the term, and so help to place and sustain our noble profession in the position which it ought to occupy. (William Stokes, 1861.)

Rufus Cole
Hospital of the Rockefeller Institute,
New York City

RAYMOND B. EARLE[1]

We unveil this portrait of Professor Earle, the gift of his wife to Hunter College, not because those of us who were so fortunate as to know him, ever need any portrait to keep his memory living in our hearts. That beloved memory is too securely enshrined. We have no need for ourselves, to recount his successes or his charm. But for the sake of those who did not know him, memory lingers now a moment to view some of the sources and manifestations of his power.

Born in Massachusetts of an old and honorable line, his first ancestor here, Ralph Earle, came from England in that stirring seventeenth century which planted this new-world republic, and that name is still borne in the family by his brother Ralph Earle, now almost 300 years later.

In his youth our Professor Raymond Earle felt the charm of nature; began to make collections of specimens; and pressing on to College, studied geology at Harvard under the inspiration of Professor Shaler, an influence which never left him, and was always an ideal. Taking his A.B. degree at Harvard in 1900, his Sc.B., 1901 he followed with his Sc.M., 1912 and Sc.D., 1913, at New York University, after a period spent as a lawyer and economist geologist.

At New York University he taught, 1911–1913, in the department of geology under Professor J. E. Woodman. To Hunter College he came in 1913, becoming associate professor of geology, and building up what became by 1917 one of the largest of geology departments among colleges for women. He had just begun his sixth year here, in the prime of vigor and only the forty-first year of his age, at the time of his sudden death of pneumonia, November 10, 1918.

He was equally at home in geology or in physical or economic geography. His research specialty had been in iron ores, with other investigations local to the Hudson. He was especially successful as a teacher in arousing and sustaining the enthusiasm of his students in his subject. He also carried over the benefits of his legal training and practise into the applications of his science. He was an extensive traveller, alone, or later with parties, conducting the latter with the purpose of giving scientific and educational views of our country, particularly in California and Alaska. He kept up his interest in a wide field of nature; his collections of birds' eggs is now at Hunter College, and many anthropological collections of Indian stone tools and weapons, pigmy bird-points of exquisite work, etc.

He was an organizer and the first director of the summer session of Hunter College, and a founder of the Physiographer's Club of New York City. He also gave public lectures here and elsewhere through the State.

A reader and forceful speaker, a skilled organizer, an intuitive discerner of human nature, Professor Earle was an unusually happy combination of the qualities which insure success. To them he added the attraction of his frank, genial, sociable, daily life at college; and at home there followed the fitting seal to his day, when in true fulfilment of his quiet but deep religious nature he gathered his little family around the evening table, and gave thanks to the Divine Giver for the blessings of the day.

[1] Memorial address at Hunter College, New York City, by Edward S. Burgess, on the unveiling of a portrait of his associate, Professor Earle, March 1, 1920.

RESOLUTIONS ON THE DEATH OF MEMBERS OF THE MELLON INSTITUTE

The following resolutions have been adopted by the Robert Kennedy Duncan Club, the organization of the Industrial Fellows of the Mellon Institute of Industrial Research of the University of Pittsburgh, on the death of three members of the Institute, viz.: Dr. David Shepard Pratt (d. Jan. 28), for three

years, until January 1, 1920, an assistant director; Dr. Francis Clifford Phillips (d. Feb. 16), emeritus professor of chemistry at the University of Pittsburgh; and Dr. Leonard Merritt Liddle (d. Feb. 21), since 1913 an industrial fellow.

WHEREAS, Dr. David Shepard Pratt, recently an assistant director of the Mellon Institute, was intimately associated with the work of many of us and was our true friend and adviser, and

WHEREAS, Dr. Pratt has faithfully employed his talents in our behalf and has made his breadth of knowledge, his fertile imagination and his keenness of perception of great practical assistance to us both by active cooperation in the laboratory and by helpful suggestion; therefore be it

Resolved, That we, the members of the Robert Kennedy Duncan Club, take this opportunity of expressing our sense of sorrow at his untimely death.

Be it further resolved, That we deplore the loss of one who was utilizing his many talents for the good of American industry.

WHEREAS, Dr. Francis Clifford Phillips, our distinguished colleague, was loved by us because of his kindly and genial ways, his unselfish consideration of others and his humor, and

WHEREAS, Dr. Phillips has brought fame both to himself and to the University of Pittsburgh, by his scholarship, his ability as a teacher and his remarkable contributions to the advancement of science, and

WHEREAS, Dr. Phillips has been an inspiration to all who knew him by reason of his personal qualities and his devotion to science. Therefore be it

Resolved, That we, the members of the R. K. D. Club, express our sadness at the close of his beautiful life of service.

Be it further resolved, That we believe that American science has lost a most sincere student and investigator.

WHEREAS, Dr. Leonard Merritt Liddle has been a friend and associate among us for the past eight years and has endeared himself to each of us by his spirit of helpfulness, his kindliness and his good fellowship, and

WHEREAS, Dr. Liddle has stood out as leader in the Institute in scientific ability, in untiring energy, in devotion to his chosen profession and in loyalty to the best ideals of the Mellon Institute. Therefore, be it

Resolved, That, we, the members of the R. K. D. Club, wish to express our profound sorrow at the loss of our comrade and sincere friend, who has been cut down thus early in his useful career. We also deeply regret the removal of one who was devoting his life to the betterment of American industry by the application of science to the solution of its problems.

SCIENTIFIC EVENTS

MEMORIAL TO SIR WILLIAM OSLER[1]

A PUBLIC meeting was held in the University Museum, Oxford, on March 6, to initiate a memorial to the late Sir William Osler, Bart., Regius professor of medicine in the university for the past fifteen years. The vice-chancellor presided. Sir Clifford Allbutt, who introduced the proposal, paid a feeling and eloquent tribute to the memory of Sir William Osler, to the wide range of his intellect, and to the singular charm of his character. He referred to his international reputation and to the binding influence he had on the medical profession in many lands, to his love of peace and goodwill, and to the extraordinary power he exerted in diffusing without diluting friendship. The president of Magdalen, Sir Herbert Warren, mentioned the many-sidedness of Osler's interests and activities, the breadth and accuracy of his scholarship, and the clear and steady optimism with which he regarded life and its progress in all ages. Sir William Church, who introduced the specific proposal that the memorial should take the form of an Osler Institute of General Pathology and Preventive Medicine, stated that such a memorial as that suggested would be a singularly appropriate tribute to the outlook and ideals that Osler had kept before him in his life-work Professor Thomson emphasized the need of new laboratory accommodation in Oxford for teaching and research. The dean of Christ Church and Sir Archibald Garrod also spoke. It was announced that the honorable secretary, Professor Gunn, had received expressions of sympathy with the proposed memorial from a large number of people representing many interests, and that a collateral committee had been formed in America to aid in raising the memorial.

[1] From *Nature.*

THE CORNELL UNIVERSITY ENTOMOLOGICAL EXPEDITION TO SOUTH AMERICA OF 1919-20

Under the leadership of Professor J. Chester Bradley the Cornell University Entomological Expedition to South America of 1919-20 is carrying on entomological investigation and making collections in various South American countries.

Dr. Bradley sailed for Brazil early in September last on the steamship *Vestris;* owing to a fire developing in one of the holds of the steamer, a delay of thirteen days occurred at the Island of Santa Lucia, where interesting and unexpected collecting was done. At Rio de Janeiro he was joined by a volunteer assistant, Mr. R. Gordon Harris.

After spending some time in Rio de Janeiro, a trip was made in company with Brazil's foremost entomologist, Dr. Adolph Lutz, to the State of Minas Geraes in the north, as far as to Pirapora, the head of navigation on the Sao Francisco River; some days were spent at Lassance on the Rio das Velhas as guests of the Institute Oswaldo Cruz. It was at this place that Dr. Chagas first worked out the details of the transmission by a Redwing bug (*Conorhinus*) of a trypanosome causing a very serious endemic disease of the region. Some days were also spent on the alpine meadows at Diamantina, Brazil's highest city, and also as guests of the State of Minas Geraes at the Capital, Beldo Horizonte.

Returning to Rio de Janeiro, the party proceeded to cross the States of São Paulo and Matto Grossa by sail to Corumba on the Paraguay River, and thence to Urucum. Interesting collecting was encountered at various points along this trip, but especially at Urucum, 20 kilometers from Corumba, on an isolated mountain range at an elevation of 2,200 feet, at the upper limit of a tropical forest. Here, despite continuous rainy weather, a very interesting and abundant fauna was encountered.

From Corumba they proceeded by rail via São Paulo to Uruguayana on the Uruguay River, at the Argentinean frontier, a distance of 2,500 miles; from there they were about to proceed, when last heard from, to the Falls of the Iguazu on the Alta Parana River.

The plans of the party contemplate spending a brief while in Argentina, at Buenos Aires, La Plata, Cordoba, Mendoza and possibly Tucuman, a visit to Montevideo, and then to spend from six weeks to two months in Chile, visiting several places, to as far south as Chiloe Island; thence to Oruro, Cochabamba and La Paz in Bolivia, and to Lima in Peru.

At Lima Dr. W. T. M. Forbes and Jesse Williamson will join the expedition, which will, if conditions prove favorable, cross the Andes via the central route and down the Pichis, Pachitea, Ucayalli and Maranon Rivers to Iquitos; stopping at favorable points on the eastern side of the Andes. The party will return to New York in September next.

The expedition is entrusted with the delivery of extensive collections of North American insects and of vertebrates to four scientific institutions in South America. While not neglecting general collecting, Dr. Bradley is devoting especial attention to the collection of Hymenoptera, especially of the aculeates, and is endeavoring to obtain series of nests of Vespidæ with their inhabitants. Mr. Harris is doing general collecting of insects. Dr. Forbes will devote his attention primarily to Lepidoptera, and relieve the other members of the necessity of devoting attention to this time-exacting group after he joins the expedition. Mr. Williamson will collect Odonata.

ST. LOUIS MEETING OF THE AMERICAN CHEMICAL SOCIETY

The spring meeting of the American Chemical Society will be held with the St. Louis and University of Missouri Sections in St. Louis, April 13 to 16, inclusive. Every indication points to the fact that the meeting will be one of the largest and most interesting ever held in the West by the American Chemical Society. St. Louis is the center of the rapidly growing Middle West and contains large and varied chemical interests. It has always been the leading drug center of the West, and leads the country in the production

of synthetic pharmaceuticals, alkaloids, and anaesthetics. St. Louis possesses all the units of a balanced, self-sufficient chemical industry. It is a center for ceramics, glass, paint, lead and zinc manufacture. The following excursions are planned: Laclede By-Products Coke Plant; Monsanto Chemical Works, East St. Louis plant; Laclede-Christy Clay Products plant; Standard Oil Refinery, Wood River, Ill.; and Illinois Glass Company, Alton, Ill.

The general program is as follows:

Tuesday, April 13

10 A.M.—General meeting, Hotel Statler.
Address of welcome, Honorable Henry W. Kiel, mayor of St. Louis.
Response, Dr. W. A. Noyes, president, American Chemical Society.
Address, Honorable E. P. Costigan, tariff commissioner, "Chemical industry and legislation."
Address, Dr. Chas. H. Herty, editor, "Victory and its responsibilities."

2 P.M.—Hotel Statler, general meeting.
J. H. Hildebrand, "The prediction of solubility."
Victor Lenher, "Selenium oxychloride a neglected inorganic solvent."
E. T. Wherry, "Studying plant distribution with hydrogen ion indicators."
Three additional general papers to be announced.

8 P.M.—Missouri Athletic Association. Smoker for men.

8 P.M.—Theater party for ladies.

Wednesday, April 14

9 A.M.—Hotel Statler, divisional meetings.

2 P.M.—Excursions to Laclede Gas Works, Monsanto Chemical Works, East St. Louis plant, and Laclede-Christy Clay Products plant. Automobile tour for ladies to parks, Art Museum, Washington University, Missouri Botanical Garden and tea at Bevo Mill.

8 P.M.—Central High School. Public address. Speaker and subject will appear in final program.

Thursday, April 15

9 A.M.—Hotel Statler, divisional meetings.

2 P.M.—Hotel Statler, divisional meetings.

8 P.M.—Hotel Statler, subscription banquet.

Friday, April 16

9 A.M.—Excursion to Standard Oil Refinery, Wood River, Ill., and Illinois Glass Company, Alton, Ill.

The Division of Industrial and Engineering Chemistry will hold a symposium on Cellulose Chemistry, this symposium having been organized by Mr. Jasper E. Crane, and will devote the remainder of its program to general papers.

A Section of Leather Chemistry has been authorized to establish a forum for the discussion of the chemistry of leather manufacture and other closely allied industries.

A Section of Sugar Chemistry will also meet for the first time in St. Louis, under the chairmanship of C. A. Browne, with Frederick J. Bates, of the Bureau of Standards, as secretary.

The Division of Physical and Inorganic Chemistry will give a half day to a "Colloid Symposium."

Papers are promised by Col. W. D. Bancroft, Albert V. Bleininger, Martin H. Fischer, and John Arthur Wilson.

Members who are to read papers having a popular appeal are requested to send synopses of them for the use of the A. C. S. News Service, care of American Chemical Society, 35 E. Forty-first St., New York City. A short abstract (about 100 words) should be sent with the title of papers or handed to the secretary of the division at the time of presentation, so that it may appear in SCIENCE.

The final program will be sent about April 5 to all members signifying their intention of attending the meeting, to the secretaries of sections, to the council, to members of the St. Louis and University of Missouri Sections.

CHARLES L. PARSONS,
Secretary

THE UNITED STATES FOREST SERVICE

SECRETARY MEREDITH has selected Colonel W. B. Greeley, assistant forester in the Forest Service, for chief forester to succeed Colonel Henry S. Graves, on the latter's retirement on May 1. Colonel Greeley is a graduate of the University of California and the Yale Forest

School, and has been in the Forest Service continuously since 1904, except for two years of military service with the American Expeditionary Forces.

From 1906 to 1908 he was supervisor of the Sequoia National Forest in California. After a short period of service in the Washington office he was appointed district forester in charge of the National Forests of Montana and northern Idaho, with headquarters at Missoula, Mont. In this position it fell to him to protect these forests, having a total area of over 29,000,000 acres, at the time of the great fires in 1910. The following year he was appointed assistant forester and placed in charge of the branch of silviculture, now the branch of forest management, in the Washington office. This branch has supervision of all national forest timber sales and timber cutting, together with other important lines of work.

With the opening of the war it was decided to raise and send to France forestry troops, and their recruiting was assigned to Colonel Greeley. To prepare the way for their operations in the French forests, the chief forester, Colonel Graves, was sent to France and attached to the General Staff. After Colonel Graves returned to the United States, Colonel Greeley took his place and finally became chief of the forestry section in the American Expeditionary Forces, in charge of 21,000 forestry troops and 95 sawmills, with lumbering operations scattered from the zone of military operations to the Pyrenees and from the Swiss border to the Atlantic.

Colonel Graves, in presenting his resignation after ten years of service as chief forester, wrote:

> Since the pecuniary returns afforded professional and scientific men in the government service inadequately provide against the exhaustion of the working powers which must inevitably take place in time, and entail sacrifices from which employment elsewhere is free, the only course consistent alike with self-respect and a regard for the public interests seems to me to be retirement from office before efficiency has been impaired. Present conditions, which amount to a heavy reduction in the rate of compensation in practically every branch of the government service, emphasize this point of view.

SCIENTIFIC NOTES AND NEWS

At the mid-year commencement exercises of the University of Pittsburgh honorary degrees were conferred upon Dr. William H. Nichols, retiring president of the American Chemical Society, and Dr. William A. Noyes, present president.

Dr. W. W. Campbell, director of the Lick Observatory, has been appointed "Commander of the Order of Leopold II." by King Albert, of Belgium. Dr. Campbell has also been elected to honorary membership in the Royal Institution of Great Britain.

Professor Wilder D. Bancroft, of Cornell University, at present chairman of the division of chemistry of the National Research Council, has been elected a foreign member of the Chemical Society, London.

Dr. F. G. Novy, of the University of Michigan, has been elected a corresponding member of the Society of Biology, of Paris, and associate member of the Royal Society of Medical and Natural Sciences of Brussels.

Dr. Frederick P. Gay, of the University of California, has been elected an honorary member of the Philadelphia Pathological Society.

Professor A. Fowler, professor of astrophysics, Imperial College of Science and Technology, London, has been elected a corresponding member of the Paris Academy of Sciences, in succession to the late Professor E. Weiss, of Vienna.

Professor R. A. Sampson, astronomer royal for Scotland, has been appointed Halley lecturer at the University of Oxford for 1920.

Dr. Arthur L. Day, who has been engaged in research work at the Corning Glass Works, Corning, N. Y., is resuming the directorship at the Geophysical Laboratory of the Carnegie Institution, Washington, D. C.

Karl Sax has been appointed biologist at the Maine Agricultural Experiment Station to take charge of the plant-breeding work.

Dr. Chester Snow has resigned as professor of mathematics at the University of Idaho, to accept a position as physicist in the Bureau of Standards, Washington.

PROFESSOR ARTHUR D. BUTTERFIELD, of the department of mathematics at the Worcester Polytechnic Institute, has resigned to become educational director for the Norton Company.

SETH S. WALKER has resigned as soil chemist to the Agricultural Experiment Station, Baton Rouge, La., to become chemist to the Florida Citrus Exchange and Exchange Supply Co., with laboratory and headquarters at Tampa, Florida.

MR. J. HOWARD ROOP, former chief chemist of feedingstuffs in the state chemists' department of Purdue University, has accepted a place as chief chemist of the Nobelsville Milling Co., Nobelsville, Indiana.

MR. HOYT S. GALE, geologist in charge of the section of non-metalliferous deposits of the U. S. Geological Survey, who recently returned from Europe where he examined and reported on the potash deposits for the Geological Survey and Bureau of Mines, is on furlough for five months to make an examination of the oil fields of eastern Bolivia. Mr. K. C. Heald, geologist of the survey, is returning from Bolivia by way of the Amazon to the east coast of Brazil.

PROFESSOR E. H. STARLING, F.R.S., has sailed for India to advise as to the locality and equipment of an All India Research Institute. Delhi, the new capital of India, has been suggested as a site for a new institute to serve as the headquarters of the research organization, but other places have been mentioned.

PROFESSOR G. N. LEWIS delivered the faculty research lecture on "Color and molecular structure" during the charter week ceremonies of the University of California.

DR. J. WALTER FEWKES, chief of the Bureau of American Ethnology, Smithsonian Institution, delivered an address on "American Archeology: Its History and Technique" before the Washington Academy of Science on March 8.

DR. COLIN G. FINK, head of the laboratories of the Chile Exploration Company, recently lectured to the graduate students, school of chemistry, Yale University, on "Industrial research" and on "The value of physical chemistry to the organic chemist."

CAPTAIN CARL W. LEWIS, head of the chemistry department of Northwestern University lectured on March 12 at Oberlin College on "Problems of Gas Warfare."

PROFESSOR PIERRE BOUTROUX, of Princeton University, lectured on "French Science" on March 18 at Columbia University.

AT a joint meeting of the Washington Academy of Sciences and the Medical and Anthropological Societies on March 31, Sir Arthur Newsholme, K.C.B., former chief medical officer of health of the Local Government Force, England, delivered an address on "The National Importance of Child Welfare Work."

THE third annual Silvanus Thompson memorial lecture of the Röntgen Society was delivered by Professor W. H. Bragg on March 2, the subject being "Analysis by X-rays."

DR. HARVEY CUSHING, Peter Bent Brigham Hospital, Boston, has been requested by Lady Osler to prepare a biography of Sir William Osler. He will be grateful to any one who will send him either letters or copies of letters, or personal reminiscences, or information concerning others who might supply such information.

WE learn from *Nature* that a meeting convened by the chancellor of the University of Cambridge and the president of the Royal Society was held on March 4, at the rooms of the Royal Society, to consider the question of a memorial to the memory of Lord Rayleigh. After a preliminary statement by the president of the Royal Society announcing the purpose of the meeting, speeches in favor of the proposal to erect a memorial were made by Mr. A. J. Balfour, Sir Charles Parsons, Dr. P. Giles (vice-chancellor of the University of Cambridge), Sir Arthur Schuster, Sir Richard Glazebrook, and Sir Joseph Larmor. It was agreed that a fund should be raised for the purpose of placing a memorial, preferably a window, in Westminster Abbey. A general committee was appointed, as well as an executive committee, to consider details, and also

the further question of raising a fund in memory of Lord Rayleigh, to be used for the promotion of research in some branch of science in which he was specially interested.

Dr. James Emerson Reynolds, professor of chemistry at the University of Dublin from 1875 to 1903, since engaged in research work in the Davy-Faraday laboratory of the Royal institution, died on February 26 at the age of seventy-six years.

Lucien Poincaré, author of works on physics and vice-rector of the University of Paris, died on March 9, at the age of fifty-eight years. M. Poincaré was a brother of President Poincaré, and a cousin of the great mathematical physicist, Henri Poincaré.

Dr. Hugo Eisig, who cooperated with Anton Dohrn in the foundation and conduct of the Naples Zoological Station, died in Switzerland on February 10, aged seventy-three years.

The American Pharmaceutical Association has available a sum amounting to about $450 which will be expended after October 1, for the encouragement of research. This amount either in full or fractions will be awarded in such manner as will in the judgment of the research committee produce the greatest good to American pharmaceutical research. Investigators desiring financial aid in their work will communicate before May first with H. V. Arny, chairman, 115 West 68th St., New York, giving their past record and outlining the particular line of work for which the grant is desired. The committee will give each application its careful attention and will make recommendations to the American Pharmaceutical Association at its meeting in Washington, May 3–8, when the award or awards will be made.

UNIVERSITY AND EDUCATIONAL NEWS

The fund for the University of Montreal (Laval), recently destroyed by fire, has attained to more than $3,500,000.

The *Journal* of the American Medical Association states that Toronto University needs $4,000,000 for its reorganized medical department. Dr. George E. Vincent, of the Rockefeller Foundation, has been in Toronto and has been conferring with the special committee of the medical department, presided over by Dr. Alexander Primrose, C.B. It is planned to pay whole-time professors in medicine, surgery, obstetrics, pathology, and perhaps one or two others, $10,000 a year. Representatives from Queens, Western at London, and from Winnipeg interviewed Dr. Vincent as to their likelihood of participating in the $5,000,000 to be allotted to Canada for medical education from the foundation.

A bequest of £4,000 has been left to the University of Manchester by the late Mr. William Kirtley, a nephew of Stephenson, who constructed the Manchester and Liverpool Railway. The fund will be used to establish a William Kirtley scholarship for the promotion of the study of mechanical engineering.

According to the forthcoming annual report of President Harry Pratt Judson, a building which the University of Chicago stands especially in need of is a research laboratory for the department of chemistry. The present Kent Chemical Laboratory is overcrowded with students. Such a building is estimated to cost about $350,000 and would be erected directly west of Kent Chemical Laboratory.

Dr. W. C. Allee, of Lake Forest College, will next year be head of the department of biology at Knox College.

DISCUSSION AND CORRESPONDENCE

THE U. S. GEOLOGICAL SURVEY

In a recent number of Science, the director of the United States Geological Survey calls public attention to the deplorable fact that the Survey is rapidly losing many of its capable geologists. He seems to ascribe this rapid depletion of the scientific staff entirely to the low salaries offered by the government as compared with the high salaries, often with privileges of investment, offered by corporations—particularly oil companies. Geologists who are familiar with the conditions in the Geological Survey during the past twenty years or more are aware, however, that the director has mentioned only one of the reasons why geologists are rapidly leaving the survey to accept more

attractive positions elsewhere. It seems important that all the other factors should be brought to public attention so that there may be a general understanding of the situation, resulting in pressure upon Congress and the officials of the administration to preserve what remains of the survey's usefulness.

The low salaries paid by the government and the needlessly strict prohibition against investments in any kind of industrial projects even remotely connected with survey work are not the only financial handicaps that beset the employees of the Federal Survey. Geologists engaged in field work often incur more or less danger—in some cases a great deal; yet a serious injury will bring no compensation from the government, but will on the contrary generally cost the injured man his position, if his usefulness has been permanently impaired. Cases of severe illness cost the unfortunate geologist full pay during the time lost, so far as it exceeds the arbitrary "sick-leave" allowance. Again, the Survey has no provision for pensioning those who have grown old and superannuated in its service.

A more important factor, as it seems to many of us, is the less interesting work now-a-days assigned to various members of the Survey. Little by little the amount of scientific research carried on by the survey has been curtailed in favor of routine statistical and classificatory activities. In large measure survey geologists have been gradually reduced from scientific investigators to technical or scientific clerks who have but little to say about the planning and initiation of their work, and who publicly get but little individual credit for the result. There are many men of zeal and high purpose who are willing to work for a relatively small salary provided they have adequate opportunities for and encouragement in the pursuit of their chosen researches; but of late the survey has not been attractive to men of this type.

Scientific research without appropriate and opportune publication soon becomes a mockery. Long delays in the appearance of survey reports have for years been the rule rather than the exception, until the situation has become a standing joke both inside and outside the bureau. Many a report of field and laboratory investigations has been held in "cold storage" year after year until it has been duplicated and superseded by the work of others. While the war greatly aggravated this condition it was an obvious tendency even before 1914.

The most serious blow which has been struck at the survey in its entire history has come within the last few months in the guise of an administrative order greatly curtailing the space and facilities available for the work of the Geological Survey. For years members of the survey endured the conditions of the old survey office building—in which the overcrowding was a national disgrace—on the assurance that a new building would soon be constructed wherein there would at last be room enough. No sooner had the survey moved into the new building, however, than the exigencies of the war prevented them from obtaining all the space to which they were apparently entitled. Now comes the order, from a source evidently lacking an understanding of how scientific work is done, greatly reducing the already limited quarters and depriving even the more important and distinguished members of the survey of their laboratories and private offices. Men of national reputation in their science are crowded together three or four in an office suitable for one. Some of the geologists are attempting to do their more important work at their homes, to which they have removed their libraries and working materials normally kept at their survey offices. Others with more fortunate connections manage to continue work in laboratories of the National Museum. Many, however, have cut the Gordian knot by resigning, and still other resignations are following from month to month.

It should be distinctly understood by every one that although the geologists of the survey need and are entitled to salaries appropriate to their positions and in keeping with the increased cost of living, the most serious defect of the survey to-day is the paucity of actual scientific opportunities either for geologists already on the staff or to offer promising young men of the stamp formerly attracted to survey

work. No reversal of the survey's present decline curve need be expected until adequate provision is made for such opportunities.

Eliot Blackwelder

Denver, Colorado,
January 22, 1920

THE AWARD OF THE NOBEL PRIZE TO PROFESSOR HABER

To the Editor of Science: The statement of the First Secretary of the Swedish legation (published in the February 27 number of Science, p. 207), relative to the award of the Nobel Prize to Professor Haber, contains some erroneous conclusions and some half-truths which should not be allowed to pass unchallenged. While Professor Haber's perfection of the commercial synthesis of ammonia amply warrants the award of the prize to him, I would comment upon the other numbered statements as follows:

2. The production of ammonia is only a step, this product being oxidized to nitric acid and nitrates by the Oswald process. While the Haber process will ultimately be of great value to the world at large, the patents, secrets, experience and profits were all Germany's (until after the war). The first secretary omitted to state that the Haber process made Germany independent of Chile saltpeter (sodium nitrate), not only for agricultural purposes, but also for the manufacture of chemicals, dyes, and especially explosives.

3. The address of Professor Bernthsen in 1912 before the eighth International Congress of Applied Chemistry in New York, was notice to the world at large that Germany could carry on war even if the British fleet cut off the Chile nitrate supply. While giving much general information, Bernthsen did not disclose all of the essential details necessary to the successful manufacture of ammonia, and of nitrates from ammonia. Therefore during the war when this country wished to use the Haber process, it became necessary for one of our large American corporations to work out the details in connection with the War Nitrates Board.

4. The statement that "the Haber plants in Germany were erected with a view to producing agricultural fertilizers" is a half-truth. This naturally was an important object, for in war as well as in peace the army and the nation must be fed, and business go on; but even more vital to Germany's purposes was the fact that ammonia meant nitrates, and nitrates meant explosives necessary for the carefully planned war, which so soon followed the perfection of the Haber process.

5. Although the first secretary disclaims knowledge of the manufacture of gas masks in Sweden, it is probable that Germany got wood or charcoal from Sweden for gas mask purposes, just as she got iron ore. No criticism attaches to Sweden for this, and her fear of Russia and proximity to Germany across the Baltic (a "German lake") readily explain her attitude toward her powerful neighbor.

However the pro-German activities of certain Swedes and Swedish-Americans, and especially the abuse of Swedish diplomatic privileges by such Germans as Count Luxberg, of "spurlos versenkt" fame, have naturally created among the Allied people an atmosphere of suspicion against Sweden; so that, especially since Professor Haber is understood to be one of those who advised and helped develop gas warfare, it is easy to understand how many believe that the award of the Nobel Prize to him was, *at this time*, ill-advised and undiplomatic.

Jerome Alexander

Ridgefield, Conn.

SCIENTIFIC BOOKS

A Handbook of Physics Measurements. By Ervin S. Ferry in collaboration with O. W. Silvey, G. W. Sherman, Jr., and D. C. Duncan. Vol. I. Fundamental Measurements, Properties of Matter and Optics. Pp. ix + 251. $2.00. Vol. II. Vibratory Motion, Sound, Heat, Electricity and Magnetism. Pp. x + 233. $2.00. New York, John Wiley & Sons, Inc. 1918.

Manuals for use in the physical laboratory have been designed from two quite distinct points of view. On the one hand, an attempt has been made to develop a series of experiments that would serve to illustrate the gen-

eral principles of physics and give the student a first-hand contact with the notions discussed in text-books, lectures and recitations. The emphasis is on the underlying ideas and the discussion of methods and accuracy of measurement is purely incidental. Books of this type are eminently suitable for students in elementary physics. On the other hand, the purpose of the manual may be to develop the theory and practise of physical measurements and to describe the construction and operation of standard measuring instruments. Such manuals are essential to the advanced student in physics and, if sufficiently comprehensive, they are useful to the student in chemistry or biology.

Professor Ferry's work belongs to the second category although a few of the experiments described would not be out of place in a manual of the first type. It is a thorough revision and rearrangement of an earlier book on "Practical Physics," by Ervin S. Ferry and Arthur T. Jones, to which chapters on sound, optics, electricity and magnetism have been added. The scope and method of the work are adequately indicated by the following quotations from the author's preface: "Only those experimental methods have been included that are strictly scientific and that can be depended upon to give good results in the hands of the average student. Although several pieces of apparatus, experimental methods and derivations of formulæ that possess some novelty appear, our fixed purpose has been to use the standard forms except in cases where an extended trial in large classes has demonstrated the superiority of the proposed innovation." "It has been assumed that the experiment is rare that should be performed before the student understands the theory involved and the derivation of the formula required. Consequently the theory of each experiment is given in detail and the required formula developed at length. The more important sources of error are pointed out, and means are indicated by which these errors may be minimized or accounted for."

Several of the methods of measurement described involve the use of instruments of special design not likely to be found outside of the author's laboratory but the greater part of them can be carried out with the apparatus that should be found in any well-equipped laboratory. The theory and manipulation of the more important modern instruments of precision are comprehensively treated and any student who has occasion to use such instruments will find these sections of the work very useful. The work is well adapted for use as a text in second- or third-year laboratory courses in physics. It should also find wide use as a reference book, in any laboratory where physical instruments and methods are occasionally used.

A. DEF. P.

SPECIAL ARTICLES

NOTICE OF A RECENT CONTRIBUTION TO STATISTICAL METHODS

PROGRESS in science is measured, among other things, by the extent to which the qualitative treatment of problems is supplemented by a more rigorous quantitative treatment. The introduction of quantitative methods into the biological sciences, however, is beset with unusual difficulties. The highly complex and variable nature of the subject matter generally demands the empirical procedure of the statistician rather than the deductive one of the mathematician, and this is true of many problems of physical science as well, for example, those of meteorology. One of the main difficulties to be overcome arises from the simultaneous variation in the magnitudes of the many variables concerned. Especially is this true in "field" investigations where artificial control over the variable is impossible; as, for example, in marine ecology. In order to meet this difficulty the authors have prepared a paper entitled: "The functional relation of one variable to each of a number of correlated variables determined by a method of successive approximation to group averages." The introduction is written by Wm. E. Ritter under the title: "A step forward in the methodology of natural science."

[1] *Proc. Amer. Acad. Arts. Sci.*, Vol. 55, Dec., 1919, pp. 89–133.

This paper presents the development of a general method of ascertaining the relation between a dependent variable and each of a number of mutually correlated ones *without being compelled to employ an assumed or predetermined mathematical function.* This is accomplished by applying to the observed values of the dependent variable successive corrections based upon each value of all the independent variables. In this way is obtained a series of averages of the dependent variable corresponding to a series of averages of each one of the independent variables in turn and corrected to a constant value of each of the remaining ones. The method is concretely illustrated by an application to a bioclimatic problem; that of predicting the yield of South Dakota wheat from temperature and precipitation.

A limited number of reprints are available for distribution. Requests for them should be mailed to the Scripps Institution, La Jolla, California.

Geo. F. McEwen
Ellis L. Michael

THE AMERICAN CHEMICAL SOCIETY
VII

Calorimetric determinations of the energy in yolk-protein and yolk-fat of doves and pigeons: Oscar Riddles. Individual entire egg-yolks were separated into (boiling) alcohol-ether soluble and insoluble fractions. These moisture-free portions considered as yolk-protein and yolk-fat were burned in a Riche bomb calorimeter. Determinations were separately made upon yolks from various pure species and hybrids. The energy per gram of the yolk-protein of pure species averages 5,497 (small) calories; for hybrids practically the same (5,457). The energy per gram of yolk-fat of pure species averages 9,020 calories; for hybrids probably it is less (8,897). The range of variability for yolks from individual hybrids is plainly greater than for yolks from pure species.

Some properties of the placental hormone: Paul M. Giesy. This substance, injected subcutaneously into the female animals, causes growth of the mammary glands and uterus. It was extracted by treating ground placentas with alcohol. In water, some, but not all, of the substance dissolves. It is dissolved by benzene, chloroform, carbon tetrachloride, absolute alcohol, ether and ethyl acetate, but not by petroleum ether. If the extract is shaken with a mixture of water and benzene, the benzene solution alone is physiologically active. Alcoholic solutions and aqueous emulsions lose their activity on standing. The activity appears to be destroyed by continued heating.

The preparation of fatty acid esters of cholesterol: G. D. Beal and J. B. Brown. (By title.)

Comparative analysis of fibrin in the presence of various aldehydes: George E. Holm and Ross Aiken Gortner. The comparative action of various amounts of paraldehyde, benzaldehyde, butyl and isobutyl aldehydes to that of formaldehyde when present in the acid hydrolysis of fibrin and gelatin was studied. In all cases the acid insoluble humin nitrogen increase is greater than with $(CH_2O)_3$ and a maximum is reached and maintained even in the presence of large excesses of these aldehydes. The ammonia nitrogen, soluble humin nitrogen and total amino nitrogen of the filtrates from the "humin" do not alter significantly. Using trioxymethylene, the increase in insoluble humin nitrogen is due to the presence of the indole nucleus, while with the other aldehydes tyrosin also enters into this reaction.

The preparation of cholesterol in quantity: Paul M. Giesy. One hundred pounds of cattle spinal cords were ground, dehydrated with alcohol and extracted fourteen times with ether. The ether was evaporated from the extract, and the residue saponified by boiling with alcoholic sodium hydroxide. After evaporating the alcohol, the residue was taken up in water and extracted with ether. The ether was evaporated from the extract, and the cholesterol crystallized from alcohol. The first crop was cream-colored and melted at 147.1° corrected. The second crop was brown, and melted at 146.4°. The total yield is about two pounds. The color can be removed by recrystallization from alcohol.

The influence of aspartic acid and asparagin upon the enzymic hydrolysis of starch: H. C. Sherman and Florence Walker. (By title.)

An improved technic for measuring lipase activity in animal or plant extracts or tissues: Leroy S. Palmer (By title.) The material to be tested is added in the form of an extract or finely minced paste to at least 75 c.c. of artificial "milk," prepared by grinding a suitable oil into hydrated acacia and diluting the emulsion with water. HCHO 1: 1,500 is added to the "milk" as preservtive. The initial acidity is determined by with-

drawing a 25 c.c. aliquot and adding it to 100 c.c. of acetone-ether (2: 1), and titrating with 0.1 N alcoholic KOH solution, using phenolphthalein as indicator. The remainder of the "milk" is incubated for 24 hours at 38° C., with occasional rotation of the flask, and the titration repeated on another 25 c.c. aliquot. The features of the method are, (1) the use of an artificial "milk" containing no acid producing substances other than the emulsified oil, (2) the determination of the acidity on aliquot portions of the emulsion.

The influence of various antiseptics on the activity of lipase: LEROY S. PALMER. (By title.) The activity of a commercial lipase was tested using the technic described in the previous abstract. Chloroform, iodoform and acetone were found to have a marked retarding influence on the lipase, depending on the concentration of the antiseptic. Very small quantities of mercuric chloride and iodine, each completely paralyzed the lipase activity. Formaldehyde had no retarding effect up to one part in 250, concentrations between 1: 1,000 and 1: 2,000 actually having a noticeable accelerating effect on the lipase activity.

The activity of phytase as determined by the specific conductivity: F. A. COLLATZ AND C. H. BAILEY. (By title.) The hydrolytic cleavage of phytin by phytase results in the appearance of salts of phosphoric acid in the digestion mixture. The electrical conductivity of the latter is thereby increased, and may be employed as a measure of the progress of the reaction. To a water solution of phytin was added crude phytase prepared from wheat bran, and several such preparations were incubated at temperatures differing by 5° intervals from 25° to 60°. The electrical conductivity was measured every 15 minutes until it ceased to change materially. The rate of hydrolysis was accelerated by increased temperatures up to 55°, which appeared to be the optimum for this enzyme. Plotting the data, calculated to conductance at 30° in order to compensate for increased mobility of the ions at higher temperature, the curves have different shapes at each temperature. As the temperature increases to the optimum, the increase in conductivity per unit of time is more rapid at the outset, but also reaches approximate equilibrium more promptly.

The fermentation of fructose by a group of pentose-fermenting bacteria: W. H. PETERSON, E. B. FRED AND A. DAVENPORT. In the fermentation of fructose by these organisms acetic and lactic acids are the chief end products. Coincident with the production of these acids is the formation of mannitol to the extent of about 20–30 per cent. of the fructose. The mannitol thus formed can be fermented to acetic and lactic acids by the same bacteria that produced it. It is suggested that the fructose first breaks down into acetic and malic acids and the latter then undergoes decarboxylation yielding lactic acid. Evidence for regarding malic acid as an intermediate product is the fermentation of malic acid to lactic acid. The strong reducing conditions set up in the breaking down of fructose into acetic and malic acid probably brings about the reduction of another portion of the fructose to mannitol.

Factors influencing the invertase activity of mold spores in sugar: NICHOLAS KOPELOFF AND S. BYALL. (By title.) The invertase activity of the spores of *Aspergillus* S. Bainier, *Aspergillus niger* and *Penicillium expansum* is exhibited at concentrations of sugar varying from 10 to 70 per cent. It has also been found that the maximum invertase activity of these mold spores occurs between 50 and 60 per cent. concentrations. It was noted that an increase in the number of mold spores is responsible for increased invertase activity in a saturated sugar solution. However, the least number of spores per c.c. of *Penicillium expansum* and *Aspergillus niger* required to produce inversion in saturated sugar solution is between 50,000 and 110,000. About 5,000 spores of *Aspergillus* S. Bainier are needed to cause inversion. The evidence that mold spores alone are capable of deteriorating cane sugar is corroborated by the data herein presented.

Carbon nitrogen ratio in relation to plant metabolism: A. M. GURJAR. (By title.) The supply of nitrogen determines the relative proportion of carbohydrates and proteins in the tomato plant. Changes in these proportions are accompanied by very marked changes in the metabolism of the plant, as follows: (*a*) Although the C: N ratio may be as high as 19 and as low as 2, the fruiting takes place only between the ratios 4 and 6. (*b*) respiration varies directly as the value of C: N ratio. (*c*) Photosynthesis varies inversely as the value of C: N ratio. (*d*) In nitrogen starved plants, catalase activity is *not* parallel to respiration, but varies inversely with it. (*e*) Under etiolation, the high carbohydrate plants are reduced to protoplasmic respiration sooner than the low carbohydrate plant, which means that the enzyme system of the former fails to make available the starch reserve. (*f*) The high carbohydrate plants

have higher respiration at 20 c.c. C., but this is not the case at 10° C. and 30° C. The above observations on tomato, together with confirmatory data on turnips and radishes, emphasize the importance of determining the proper C: N ratios for all our economic plants.

Vanillyl acyl amides: E. K. Nelson. (By title.) Following the demonstration of the structure of capsaicin, the pungent principle of red pepper, which proved to be a condensation compound of vanillyl amine (4-hydroxy-3-methoxy benzylamine) with a decenoic acid, a number of analogous derivatives of vanillyl amine were prepared by the interaction of that substance with acyl chlorides. Derivatives of the following acids were obtained: acetic, propionic, butyric, isobutyric, n-hexoic, n-heptoic, n-octoic, n-nonoic, n-decoic, n-undecoic, n-dodecoic, crotonoic, undecenoic and benzoic. As the molecular weights of these substances rise, the solubility in water decreases, while that in ether increases. Pungency, first noticeable in the propionyl compound, increases to a maximum in vanillyl octoyl amide, which is almost as pungent as capsaicin. One eight-thousandth of a milligram of this substance causes a distinct burning on the tongue. The crotonyl compound is slightly, the undecenoyl compound extremely, and vanillyl benzoyl amide very slightly pungent.

On a phenol produced by growing aspergillus tamari: J. F. Brewster. (By title.)

Climatic control in relation to plant growth: W. E. Tottingham. (By title.) Consideration of the profound effects of climate upon the growth and composition of plants, together with the difficulties of interpretation of these effects imposed by fluctuations of climatic factors, makes evident the desirability of experimental control over the latter. A fair degree of success has been realized in the installation of a small plant culture chamber for climatic control within a greenhouse. The atmosphere is conditioned for this chamber by forcing it through a humidifying chamber moistened by wet towelling, the latter being wet by water of controlled temperature. Before entering the culture chamber the air is heated somewhat, to bring both its temperature and degree of saturation with water vapor to desired values. The conditioned air enters the culture chamber beneath the flanged surface of a rotating table, which distributes it about the chamber, and escapes through orifices at the top. The rotating table also serves to equalize climatic differences for the different plant cultures carried by it. With the limited capacity of such an apparatus, it is necessary to maintain a considerable degree of control over illumination, temperature and humidity of the surrounding greenhouse, in order to realize a reasonable degree of control over climatic conditions within the culture chamber.

Studies in the translocation of nitrogenous and carbohydrate material into the wheat kernel: G. A. Olson. (By title.)

Physical and chemical studies of wheat gluten: G. A. Olson and Charles H. Hunt. (By title.)

Charles L. Parsons,
Secretary

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SECTION B—PHYSICS

Section B was in session, in affiliation with the American Physical Society, at St. Louis, December 30, and 31, 1919, and January 1, 1920. The program of papers presented through the American Physical Society are elsewhere announced and abstracted by the society. On the afternoon of December 31 occurred the annual session of Section B, the retiring vice-presidential address of Dr. Gordon F. Hull and a Symposium on "Phenomena in the Ultra-violet Spectrum, including X-rays," the papers of which will be abstracted elsewhere in Science under the above title. Dr. Hull's address on the subject, "Some Aspects of Physics in War and Peace," was printed in the issue of Science for February 5.

The Sectional Committee nominated as chairman of the Section, Professor J. C. McLennan, of the University of Toronto.

G. W. Stewart,
Secretary

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